Marlo G Abernathy
7280 Tait St
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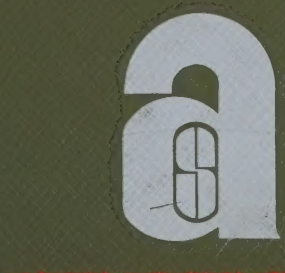

Society of Wireless Pioneers

10-28-86

ABERNATHY ALBUM (Later-additional album)

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Society of Wirele... 1915

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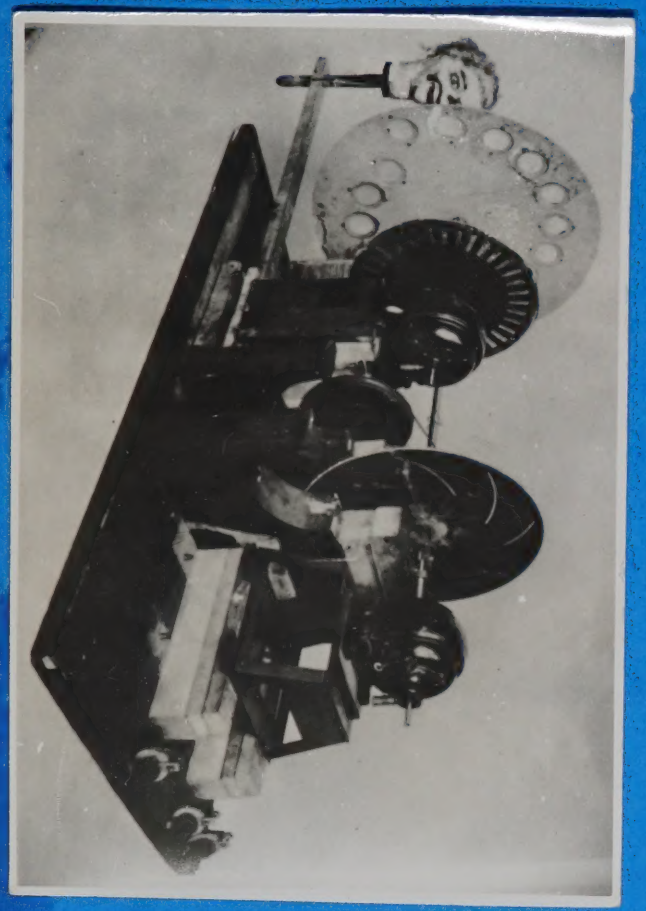
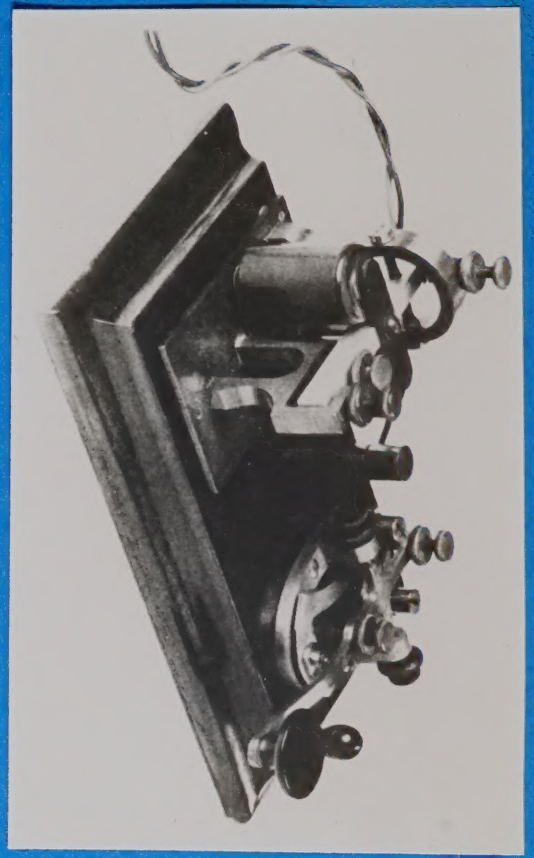
VACUUM TUBES FROM ABERNATHY

1. RADIOTRON ~~1616~~ 1616 RCA
2. HYTRON - 1616
3. WESTINGHOUSE RADIOTRON ~~1618~~ 1616
4. RCA USN 1616
5. USN - E1960

MARLO G. ABERNATHY

Library - California Historical Radio Society





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1 BELFAST LONG-WAVE RECEIVING STATION; typical view of operating room.

The complete rack is about 20 feet long and contains four receivers. All antenna leads are brought to the master antenna panel in the center of the rack.

Compensation and distribution of the signals is effected by cords and plugs to their respective rack jacks connecting to racks 2 and 3 as shown in picture *2*.

The tone telegraph board and filter equipment is shown at the far end of the room.

The antenna combining units for bringing the signal energy from the three-wave antennas into phase are in the foreground at the left.

Equipment for checking and recording speed is at the extreme right.

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2 BELFAST LONG-WAVE RECEIVING STATION; all three receiver racks. The antenna combining unit of each of the racks are in the foreground.

The antenna combining equipment consists of three combining units and three couplers; one for each antenna. The signals then pass into the primary tuner of the receiver proper, thence through the coupler into the secondary tuner, through the radio frequency amplifier to a coupling unit, through a balanced modulator detector unit and into the audio amplifier. The signals next pass through a volume control unit for regulating the energy sent out on the Belfast-New York line. From the volume control unit the signal goes to the tone control panel, where it is plugged into the input side of the filter through it is to work. The output of the filter terminates in a line balancing network consisting of line potentiometers and coupling tubes. The staff may thus monitor the output of the filters and measure the current going out on the line. This arrangement permits the line input energy to be kept at a predetermined level which is suitable for the repeaters between Belfast and New York.

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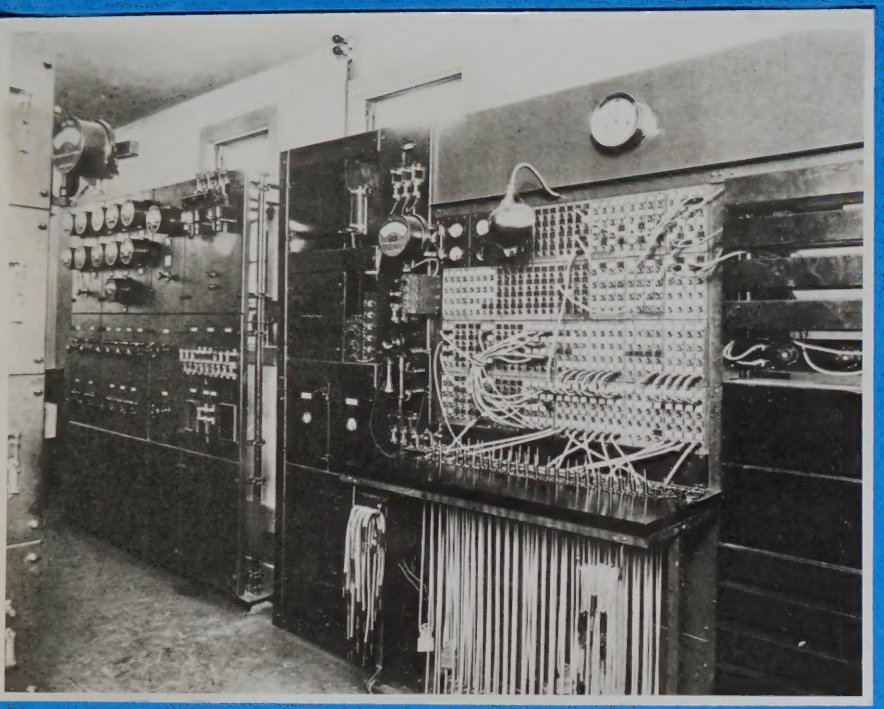

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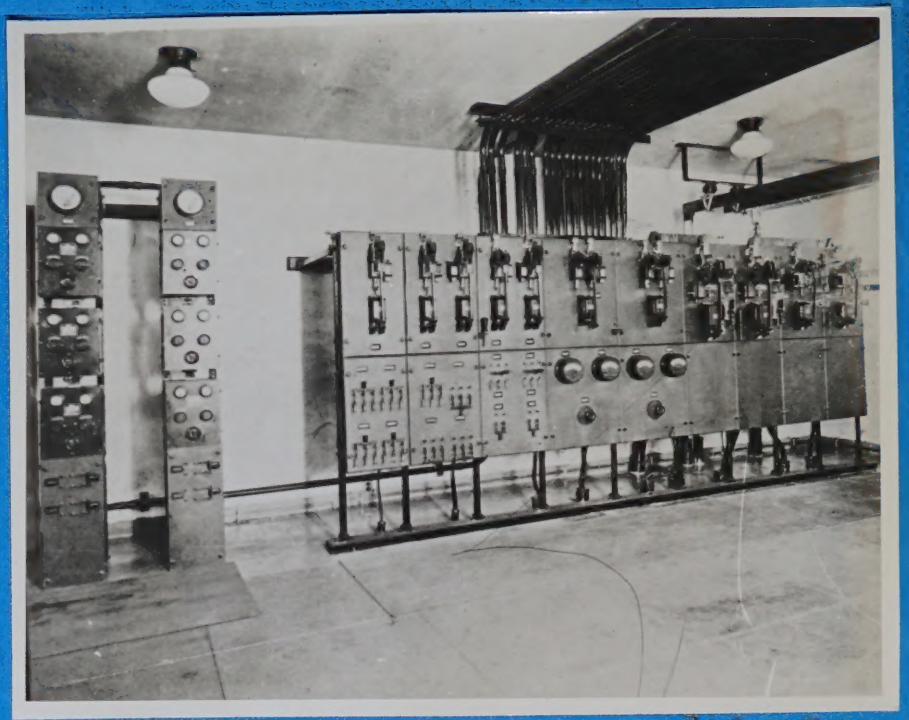
3 BELFAST LONG-WAVE RECEIVING STATION; tone telegraph board, the amplifier rack, and the control panel.

The control panel is metered to read the various grid, plate and filament loads. It is equipped with remote control switches and electrically operated circuit breakers for the control of the various motors and generators.

The tone telegraph and line measuring equipment, one unit for each line, is shown on the amplifier rack. The tone control board contains the switching for the various filters used. The filter equipment may be seen at the extreme right. This equipment is of standard Western Electric Company manufacture and is arranged for multiple operation.

Two pairs of wires Belfast with the Central Office in New York. The filter equipment installed provides thirteen available channels. Two of these are tone telegraph equipment on communication channels and the remaining eleven for transfer of the audio signals to New York.



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4 BELFAST LONG-WAVE RECEIVING STATION; a portion of the motor-generator room, the electrically operated contactor board, the Tungar equipment, and the overhead low voltage bus bar system.

The complete station load is of the order of 300 amperes. This load is carried at a maximum voltage drop of 1/10 of a volt.

It is imperative in a station of this character that there be no appreciable drop in the filament voltage of the various tubes during switching operations.

3

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5 BELFAST LONG-WAVE RECEIVING STATION; general view of the battery room.

The plate battery is of 320 ampere-hour capacity. The bias batteries, on the top rack, are of 160 ampere-hour capacity. The filament battery at the extreme lower right of the picture is of 4,000 ampere-hour capacity.

There are two groups of filament batteries, two groups of bias batteries of five cells each, and 120 cells of plate batteries in a single group.

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6 KOKO HEAD, HAWAII, LONG-WAVE RECEIVING STATION.

The construction previously illustrated at Belfast, Maine, is to be seen as typical of the Hawaiian and other long wave receiving stations.

Two wave antennas, one of which is directive on San Francisco, and one directive on Japan, provide the signal pickup systems for this long-wave receiving station. Three complete long wave receivers are shown. These may be plugged to either of the wave antennas by means of the master antenna panel at the left of the rack.

The outputs of the audio amplifiers terminate in the plug boards at the right of the switchboard racks. High speed recording equipment may be seen installed at the extreme right of the picture.

4

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7 CHATHAM RECEIVING STATION; wave antenna uni controlled superheterodyne receivers and combining units.

Reception is effected by the use of two-wave antennas. These may be used separately or in broadside combination.

The wave antennas are directed in an easterly direction with the object of covering all trans-atlantic ships proceeding over the great circle course.

Five receivers are arranged for simultaneous reception on the wave antenna combination in use.

This makes it possible to receive from five separate ships simultaneously.

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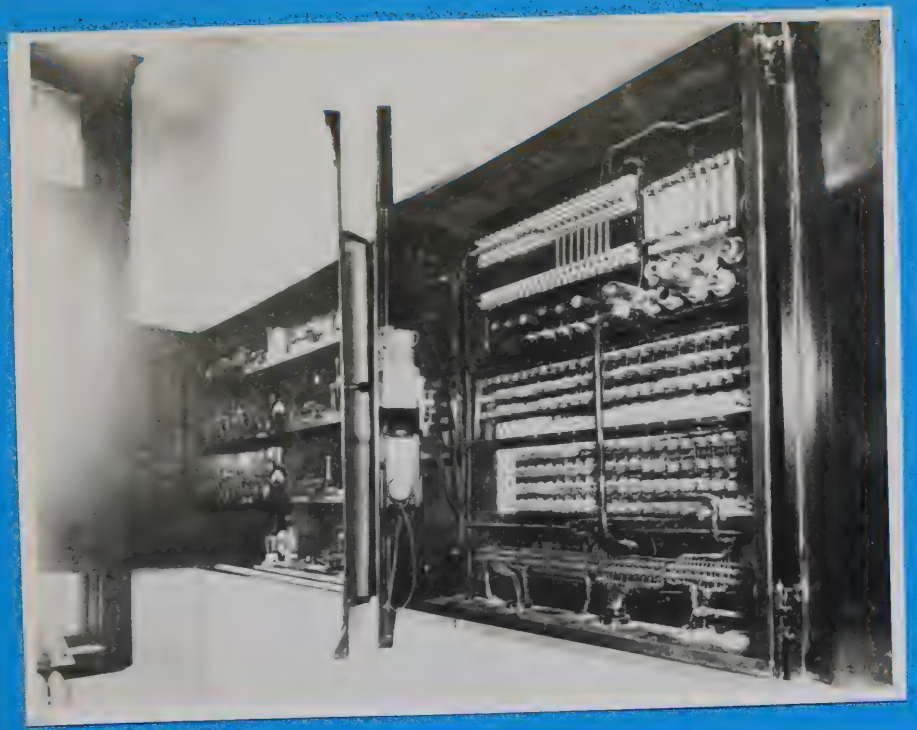
8 CHATHAM RECEIVING STATION; four superheterodyne receivers - three for long wave and one for 600 meter reception.

The transmission line connecting the loop antennas and receivers is seen entering the rear wall.

In the left foreground is shown the high-speed table with its ink recoring equipment.

5



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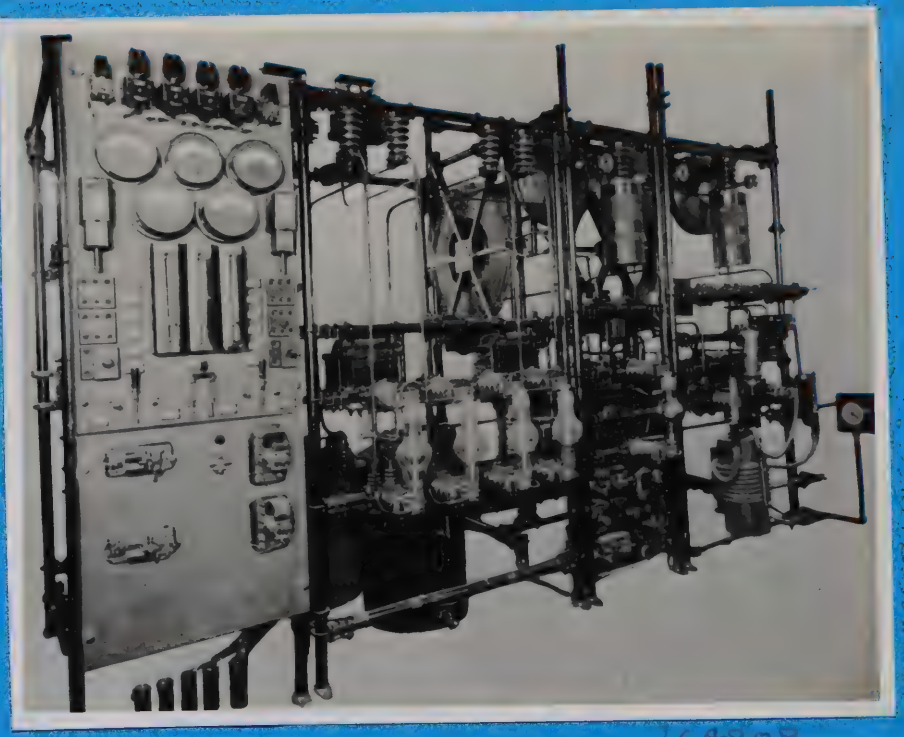
9 CHATHAM RECEIVING STATION; distant transmitter control cabinets, interior construction.

From these cabinets are controlled one 5-kw and two 10-kw tube transmitters at Marion, fifty-four miles distant, and one 5-kw local tube transmitter. A total of eight wires connect the Chatham and Marion stations.

The control wire terminations are in the jacks shown in the cabinet to the left.

Start, stop and wavelength control relays are in the cabinet to the right.



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10 CHATHAM RECEIVING STATION; 5-kw transmitter.

On the lower switchboard panel at the left are located keying, wave change and start and stop relays.

These are the essential elements for distant control of the transmitter.

Rectifier, master oscillator and power amplifier equipments are shown in order from left to right.

6

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11 CHATHAM RECEIVING STATION; arrangement of 5-kw transmitting antenna directly above the operating .

Extreme care and complete shielding of receivers permit reception of all waves although receivers are located in the field of the transmitting antenna.

The 5-kw antenna down leads are anchored at insulators on the 400-ft mast. Telegraph poles support the ground distribution busses. The antenna-tuning apparatus is located in the shed in the foreground. The operating building is seen in the center at the foot of the hill.

At both Chatham and Marion the transmitting antennas are at great distances from the transmitters. The antennas are energized by two-wire transmission lines, which vary in length from 500 to 1,600 feet.

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12 MARION TRANSMITTING STATION.

Marion, the transmitter end of the Cape Cod multiplex pair of marine stations, lies due west of Chatham forty-two miles by air line. By road the course is due west from Chatham to Sagamore, along the Cape Cod Canal and the northerly end of Buzzards Bay to Wareham. The road leads south for about six miles, suddenly bringing into view a series of towers and tall masts. We thus arrive at Marion, Massachusetts, on the west shore of Buzzards Bay.

The equipment of the Marion multiplex transmitting station is illustrated by the following views which follow.

264363

12 MARION TRANSMITTING STATION; Power house and three lattice towers supporting the marine antennas.

The towers to the left are 300 feet high, and the one to the right is 100 feet high. The structure in the foreground is the tuning coil house, which houses the tuning coils of the alternator energized multiple tuned high-power antenna.

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13 MARION MARINE TRANSMITTING ANTENNA; close-up view of the 300-foot towers supporting the 4-wire T-type, marine antenna.

A similar antenna is suspended between the lattice tower in the foreground and one of the 400-foot tubular masts of the high-power system. The third marine antenna is suspended between the lattice tower in the foreground and the 110-foot tower shown in picture *12*.

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15 MARINE STATION, TUCKERTON, N.J.

The marine station shown herewith is located at Tuckerton, New Jersey, a small town on the Jersey coast, twenty-four miles north of Atlantic City, on the main New York, Atlantic City highway. The operating building is a one-story structure.

The two self-supporting lattice masts, 100 feet high, support a double right-angle loop antenna system. This antenna is used for directional reception.

The transmitting equipment is installed at the Tuckerton Long-wave Transmitting Station.

The pair of stations provides marine service for the North Atlantic area.

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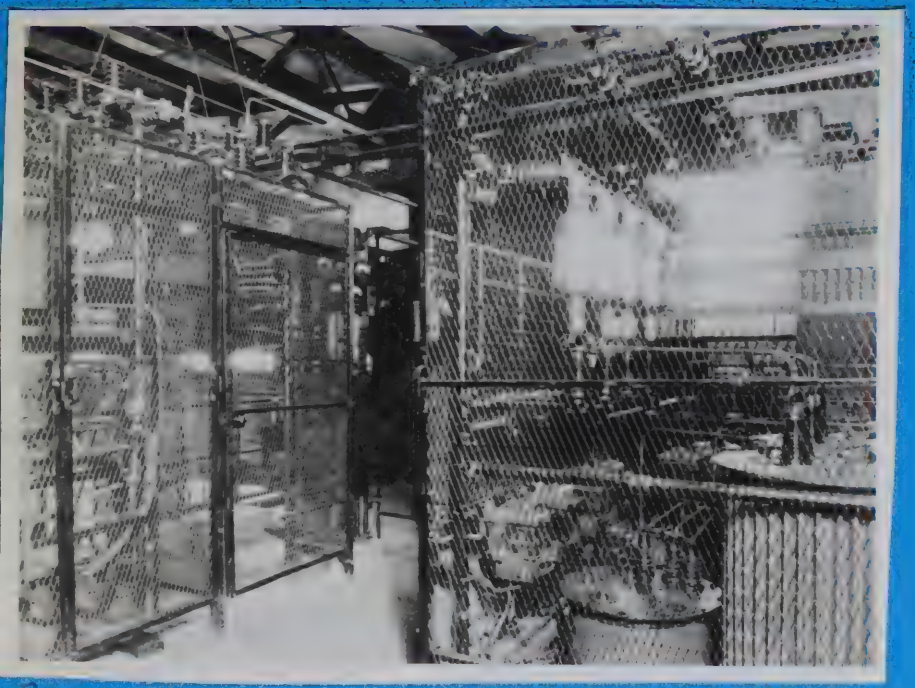

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14 MARION MARINE TRANSMITTING STATION; close-up view of 40-kw 10,000-volt rectifier, with its 4 type UV219 tubes and associated circuits.

At the left is one of the 10-kw water-cooled power amplifier tubes. The door in the diamond mesh screening leads to transmission line buss structures.

The switchboard for control of the second 10-kw transmitter may also be seen.

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16 S.S. LEVIATHAN RADIO DIRECTION FINDER; pedestal mounted loop on upper deck.

The revolving loop is completely protected from the elements by its metal housing.

The metal loop housing is electrically interrupted to allow it to function properly, while the leads from the loop are completely shielded to sharpen the directivity of the instrument.

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17 S.S. LEVIATHAN RADIO DIRECTION FINDER; view showing instrument being operated by Commander Herbert Hartley.

The revolving loop on the upper deck is mounted on an extension of the vertical shaft of the instrument.

The hand-wheel provides rotation of the loop to the exact position of minimum signal. The bearing of the radio signal with respect to true north is thereby determined.

A ship's course recorder, seen on the wall, is a useful adjunct to the radio equipment.

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18 M.S. GULF PRIDE RADIO DIRECTION FINDER; front view of R.C.A. Model FR 1445 Direction Finder.

The wave-length range of this equipment is 550 to 1,100 meters.

The radio bearing correction determined by calibration is automatically applied to give direct reading.

The receiver and battery supply is contained within the metal housing. A non-corrosive aluminum composition construction provides complete shielding and durability under prolonged exposure to the weather.

10

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19 M.S. GULF PRIDE; installation of Model ET-3626 B Transmitter and Model IP 501 Receiver.

The transmitter delivers 500 to 750 watts to the antenna over a wavelength range of 600 to 4,200 meters.

The frequency range is continuously variable, any wavelength within this band being available for transmission.

The Receiver Model IP 501, in combination with long-wave load coil IP 503, provides a receiving range from 300 to 19,000 meters.

20 RADIO CENTRAL, ROCKY POINT, LONG ISLAND; experimental short wave transmitter "2XS" 14.9 meters.

Transmitter 2XS is of the crystal controlled master oscillator power amplifier type. The crystal controls a master oscillator stage at the comparatively long wavelength of 238 meters, 1,260 kilocycles.

Four successive multiplying and amplifying stages progressively increase the frequency to 20.800 kilocycles.

The energy is delivered by the power amplifier to a transmission line which feeds the half-wave horizontal antenna in picture *21*.

From left to right are the crystal control and intermediate amplifier stages, the power amplifier stage, and in the center the 10,000-volt rectifier unit of the power amplifier plate supply.

In the right foreground are the power amplifier control and metering panels.

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21 RADIO CENTRAL, ROCKY POINT, LONG ISLAND: the half-wave horizontal antenna of the 14.9 meter experimental transmitter 2XS.

The antenna, which is supported by a pair of telegraph poles, is located between the ends of the horizontal spreaders.

A radiation ammeter may be seen, by close observation, suspended face down to the right center of the antenna. The indications of this instrument can be read from the ground.

To the left of the horizontal spreaders and attached at one end are a pair of vertical spreaders. These support three radial reflector wires.

An interesting comparison in relative sizes is afforded by noting the five 400-foot (122-meter) towers supporting the long wave antenna contrasted to the experimental horizontal half wave antenna of total length 24 feet (8 meters).

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22 RADIO CENTRAL, ROCKY POINT, LONG ISLAND; the vertical half-wave antenna and reflector system of 16.1 meter experimental transmitter "2XT".

The reflector consists of 14 parallel vertical wires arranged in a parabolic arc with respect to the single wire vertical antenna.

The antenna is energized by a transmission line several hundred feet in length. A radiation ammeter may be clearly seen located just below the lower antenna tap of the transmission line.

The antenna system is tilted to produce a more effective angle of wave propagation.

91

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*23** RADIO CENTRAL, ROCKY POINT, LONG ISLAND; four short wave transmitters installed for test under actual traffic conditions.

Each transmitter consists of two separate panel mounted units. One unit contains the crystal controlled master oscillator and the intermediate amplifier stages. The second unit contains the power amplifier stage. All controls are on the panels at the front.

Each power amplifier energizes its antenna by means of a transmission line. The transmission lines enter the building through glass-covered ports, each of which is directly over its respective power amplifier. Meters registering the radiation currents in the transmission lines.

The transmitters are provided with hinged metal screens which serve the dual purpose of mechanical protection and electrical shielding. Accessibility to all parts is readily obtained.

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24 RADIO CENTRAL, ROCKY POINT, LONG ISLAND; four 10,000-volt rectifiers for supplying the plate voltages to the power amplifier units of short-wave transmitters pictured on *23*.

These rectifier units use six type UV-219, 12.5 kw air cooled rectifier tubes in a three-phase T-connected rectifier circuit. In combination with their smoothing circuits they provide a steady source of direct current voltage at a maximum output of about 40 kilowatts at 15,000 volts.

A water interlock system in connection with the water-cooled tubes of the transmitters operates to cut off the plate voltage supply of these rectifiers when the flow of cooling water to the transmitter water-cooled tubes falls below a predetermined minimum value.

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25 HIGH POWER STATION, BOLINAS, CALIFORNIA, two bays of the short wave horizontal broadside antenna.

This antenna system consists of thirty independent vertical antennas energized from a common central distribution bus and transmission line.

The wave energy is radiated in a direction at right angles to the plane of the antenna, and is concentrated as in the Beam system.

This particular antenna arrangement at Marshall, California, is used for the interception of signals from Manila.

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26 PHOTO RADIO CHRONOMETER.

Synchronization of the transmitting light beam and the recording hot air jet is an essential element of photo radio technique.

A high grade chronometer, such as shown, is used to control the vibrational speed of a tuning fork.

A contactor seen at the extreme end of the pendulum makes contact at each swing with a minute pan of mercury.

A tuning fork associated with the chronometer contacts receives an electrical timing impulse at each swing of the pendulum.

14

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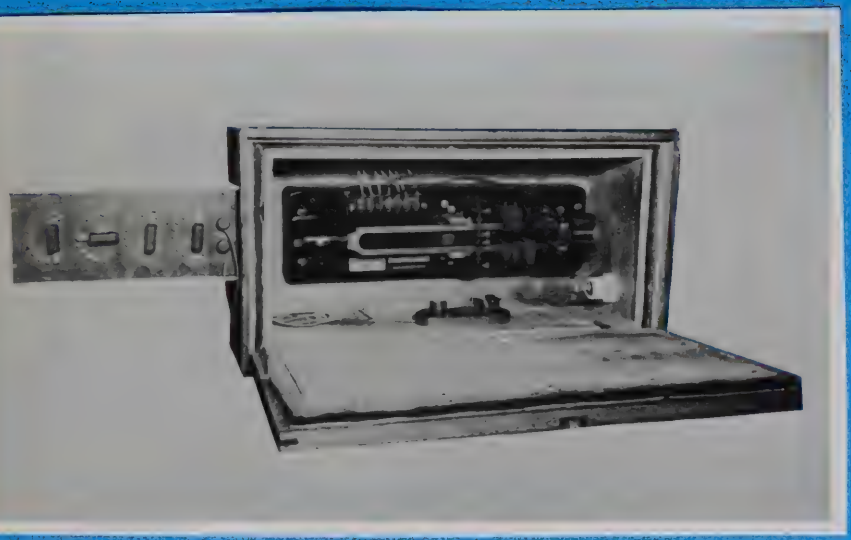

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27 PHOTO RADIO TUNING FORK.

The tuning fork vibrates at a definite period depending upon its mechanical dimensions. The fork illustrated has a period of 35 cycles per second. The driving magnet is energized in timed pulses of one second intervals by the chronometer contact previously illustrated in *26*.

The fork is mounted in an oak cabinet interlined with heavy felt. Its temperature is maintained at 90°F by means of a thermostat. This precaution prevents change of vibrational speed of the fork with temperature change.

The vibration of the fork is transmitted to contacts which in turn regulates the speed of the Photo Radio driving motor.

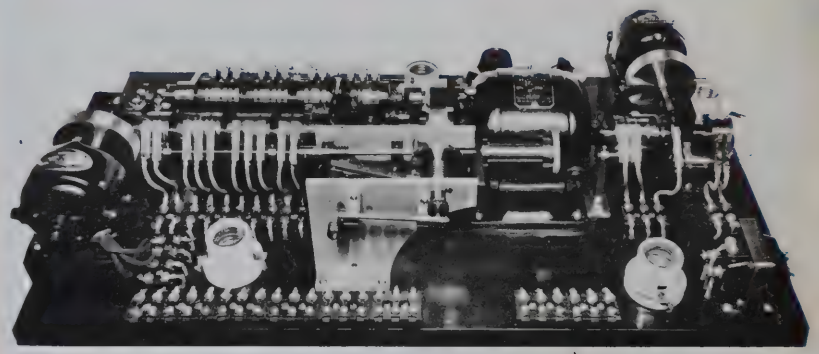

Photo Radio Master Speed Control Unit

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28 PHOTO RADIO MASTER SPEED CONTROL UNIT.

This unit uses as its driving source a direct current motor running normally at 2100 RPM. Speed is held constant by chronometer and tuning fork contacts which in turn operate to cut in or out resistance in the motor shunt field circuit.

An external commutator with cynchronizing brush provides the means for timing the field control and the tuning fork contacts. The commutator is made up in two segments, one of which is insulated.

When the fork contact coincides with brush position n the live commutator segment, field resistance is inserted, speeding up the motor.

When the motor is running at synchronous speed, the fork contact occurs in the half and half position of the commutator brush.

The master speed control unit drives a number of commutators from which any number of motors may be synchronized and controlled. The master unit thereby eliminates separate chronometers and forks in installations requiring more than one transmitter and receiver.

The practical process of synchronization is to place on the transmitter cylinder a straight vertical line. The synchronizing brush of the receiver motor is then adjusted until the recorder shows a straight vertical line. The photo transmitter and receiver are then operating in exact synchronism.

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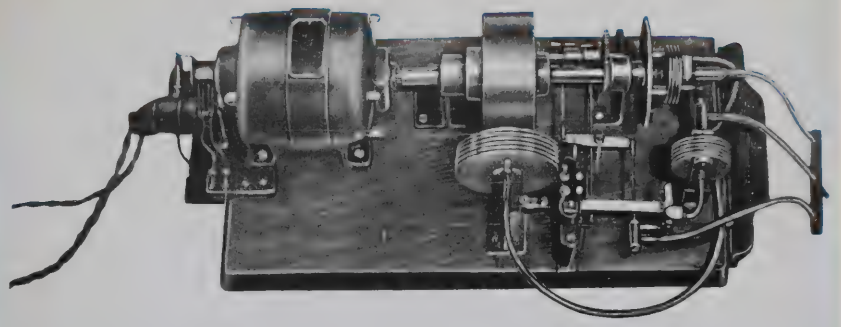

Photo Radio air controlled synchronizing motor

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29 PHOTO RADIO AIR CONTROLLED SYNCHRONIZING MOTOR.

The speed of this motor is accurately controlled by the medium of a resonant torsion pendulum, an inertia governor and a pneumatic braking system applied to the periphery of a mercury filled flywheel.

The torsion pendulum is driven by the motor from the free end of its torsion spring by means of a cam and a speed reducing gear. A portion of the pendulum passes through a gap in the compressed air line to a small bellows which controls the inertia governor. These small bellows operate to oppose the action of the inertia governor when the motor speed is high.

Hunting of the motor, or oscillation of its speed, is damped out by means of the mercury filled flywheel. The inertia governor controls a pneumatic brake which is applied to the flywheel. The motor speed is thusmaintained at the exact resonant speed of the pendulum taking into account the reduction gear ratio.

The air controlled motor is designed for installation on battleships or other congested localities where the induction due to the sparking of the commutator controlled type of motor may cause undue interference with the operation of other electrical equipments.

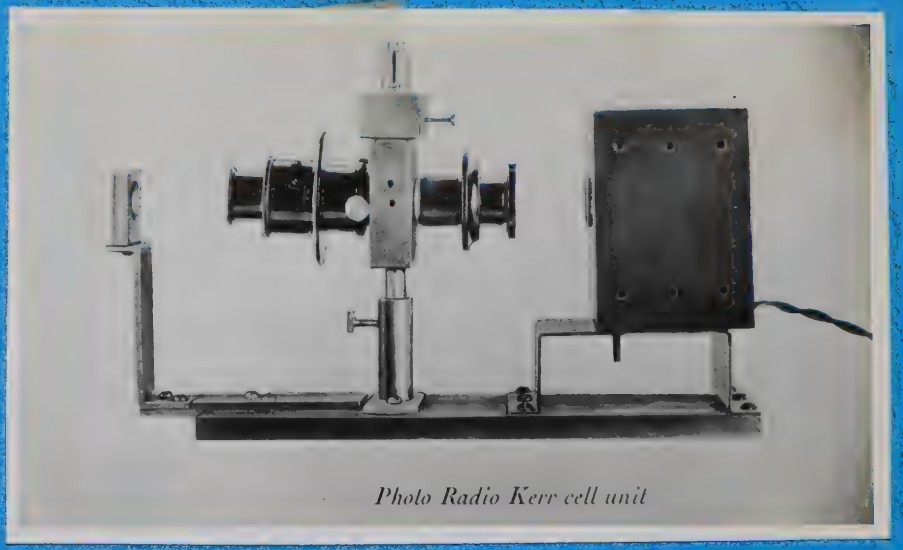

Photo Radio Kerr cell unit

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30 PHOTO RADIO KERR CELL UNIT.

This unit consists of two Nicol prisms and a solution of carbon bisulphise.

Current passing through the solution causes rotation of the plane of light polarization.

An extremely fast means for the modulation of a light beam at high speed is provided by this cell.

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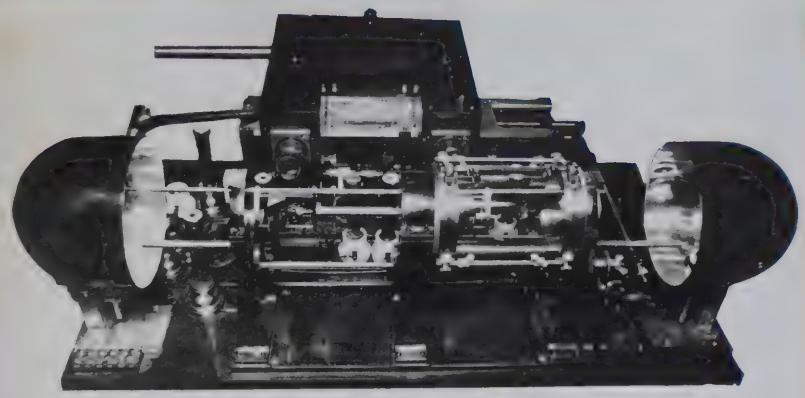

Photo Radio double transmitter. Left-hand glass cylinder has been removed to expose the optical system

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31 PHOTO RADIO DOUBLE TRANSMITTER; (left hand glass cylinder removed to expose the optical system).

A Pointolight lamp in each of the parabolic end reflectors is the source of illumination. The light beam falls on a prism carried on the oscillating spindle within the cylinder walls. It is then refracted at right angles by the prism to the traveling lens and photo-electric cells via the walls of the glass cylinder.

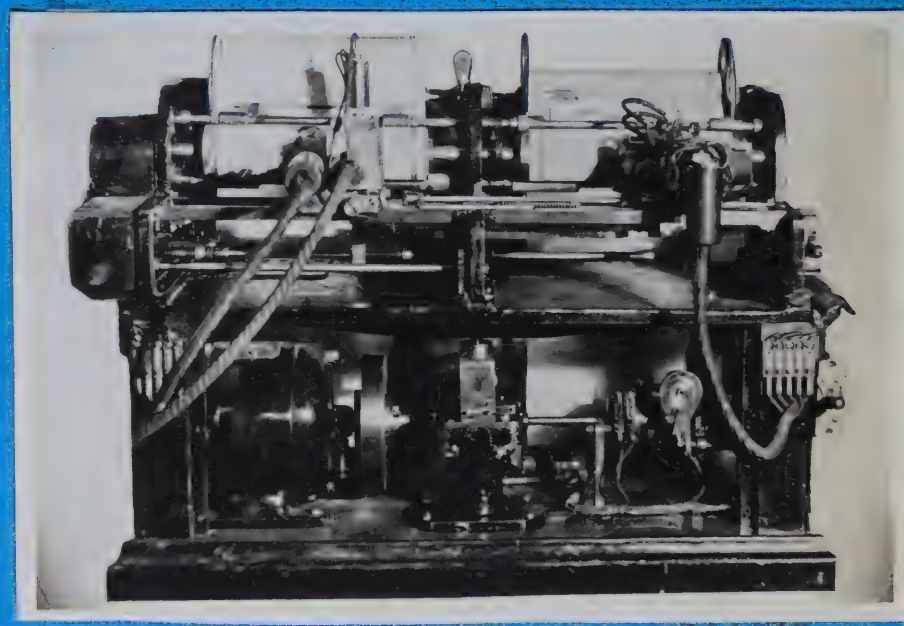
A photographic negative wrapped around the glass cylinder is penetrated by the light beam as it passed to the lens.

The lens in turn focuses the beam on an aperture so proportioned as to cover an element of the negative one ninety-sixth of an inch in width. The light beam enters the photo cell after passing through this aperture.

Complete light analysis of the negative is obtained by the continuous horizontal oscillations of the carriage carrying the prism and lens.

The negative is moved forward one ninety-sixth of an inch at the end of each horizontal stroke.

The double transmitter is capable of transmitting two pictures simultaneously. For such use of the equipment it is necessary to have two photo electric cell amplifiers, and two separate units of tone and push-pull amplifiers with their relays.



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32 PHOTO RADIO COMBINED THERMIC AND WAX RECORDER.

This instrument makes two pictures from the same transmitting subject simultaneously. One picture is recorded on heat sensitive paper by means of a hot air jet and one picture by means of direct contact with a wax-coated pen. The pictures are 5 inches in width and of length determined by the subject transmitted. The average picture is 5 x 7 inches.

The hot air jet and the wax pen are geared together and given simultaneous motion by a common driving spindle. At the end of each stroke a reversing mechanism moves the paper ahead 1/96 of an inch and sends the hot air jet and wax pen back over the paper in reverse direction. The signal impulses from the transmitter register simultaneously on the hot air jet and the wax pen, causing them to mark at the same instant. By this means, an original and copy of the transmitting subject is obtained. One of these copies is available for the customer and the other for file.

The wax pen records by means of direct contact with the paper. A steel pen is fed with red wax in liquid form through a heating coil concentric with the wick of a wax pot.

The marking contact is made by the reaction of the magnetic field of a small signal coil to which the which the lever of the pen is attached, and the field of three horizontal electromagnets which are spaced at 120°. The repulsion of the signal causes the pen to be brought into sharp contact with the paper for the duration of signal pulse.

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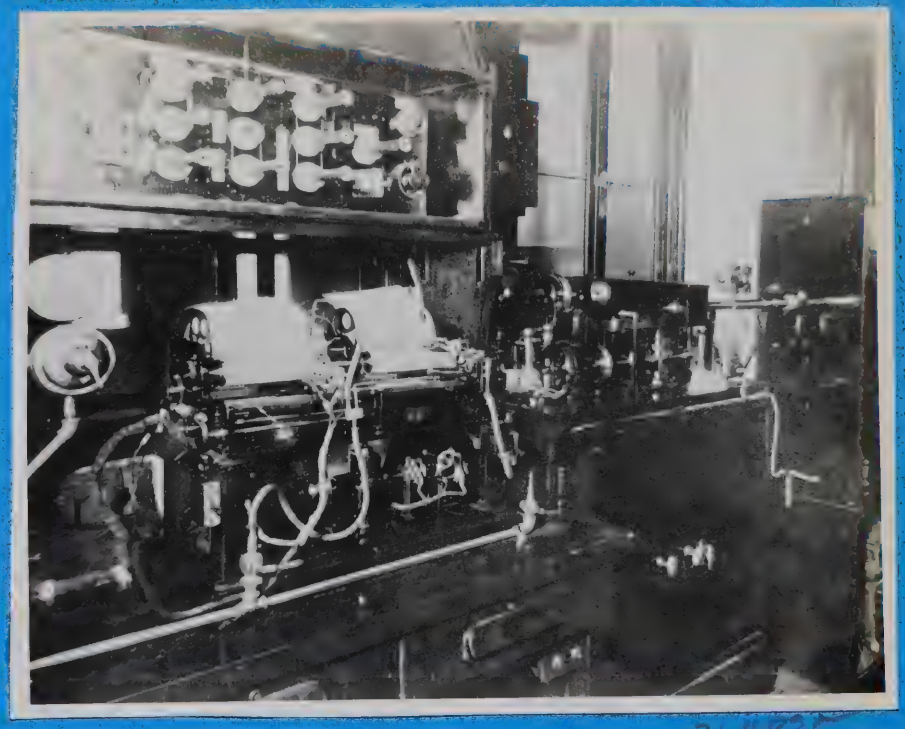
34 PHOTO RADIO INSTALLATION IN THE TRAFFIC DEPARTMENT OF THE RADIO CORPORATION OF AMERICA AT 66 BROAD STREET IN NEW YORK CITY.

Three separate tone amplifiers are visible at the left and three push-pull amplifiers at the right of the picture. A Western Union plug panel at the extreme right provides means for controlling and distributing three separate photo radio circuits.

Picturesignals from London are received at Riverhead, Long Island and at Belfast, Maine. They are piped into the traffic department by wire after having passed through a tone amplifier.

The signal pulses to the photo recorders are produced by relays which are energized from the outputs of the push-pull amplifiers shown.

A reversing switch, operating in conjunction with the front and back contacts of the relays, provides means for positive and negative reproduction.



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35 PHOTO RADIO INSTALLATION IN THE TRAFFIC DIVISION AT NEW YORK, at the left a combined thermic and wax recorder and at the right a single photo transmitter

At the extreme right is shown the photo cell amplifier. The output of this amplifier after passing theough a second stage of push-pull amplification operates a relay which controls the transmitters at the high power New Brunswick, N.J. and Rocky Point, Long Island.

Commercial picture service was inaugurated shortly before the English strike of May, 1926.

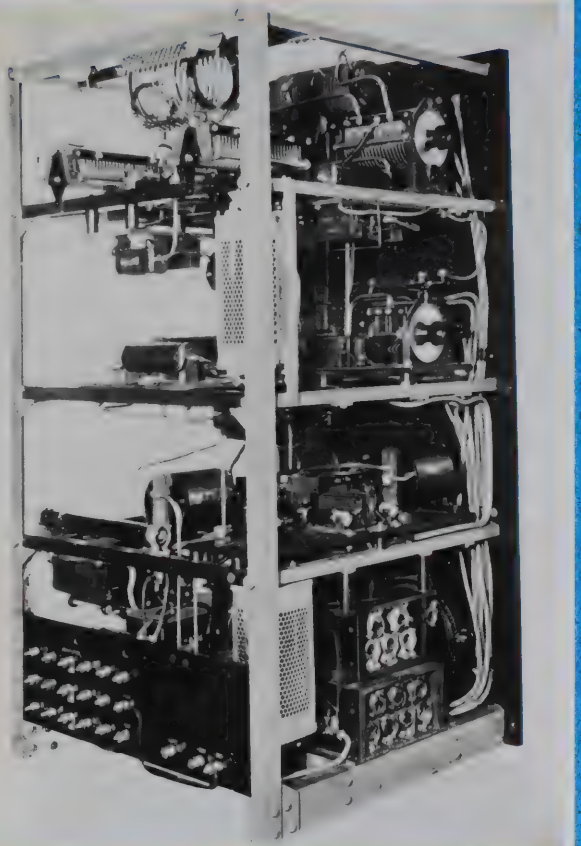
The first transmission across the Atlantic from New York was a test picture received in London in November of 1924. The first test picture from Europe was received from London on November 26th, 1924.

The service is now in commericfal operation and regularly used by news and picture agencies, as well as by Department stores and Fashion shops.

78

MARLO G. ABERNATHY

MARLO G. ABERNATHY



764978

36 200-WATT SHORT-WAVE MARINE TRANSMITTER; viewed from rear corner with side panels removed.

This set is designed to provide a compact crystal controlled short wave transmitter for Marine and Emergency use.

The equipment is mounted on a panel 39 x 21 inches and is 20 inches deep.

The master oscillator stage is crystal controlled. It is followed by two amplifying and frequency doubling stages.

Two small motor generator units, not shown, are required in addition; one to supply plate and filament voltages and the other to supply grid biasing voltage.

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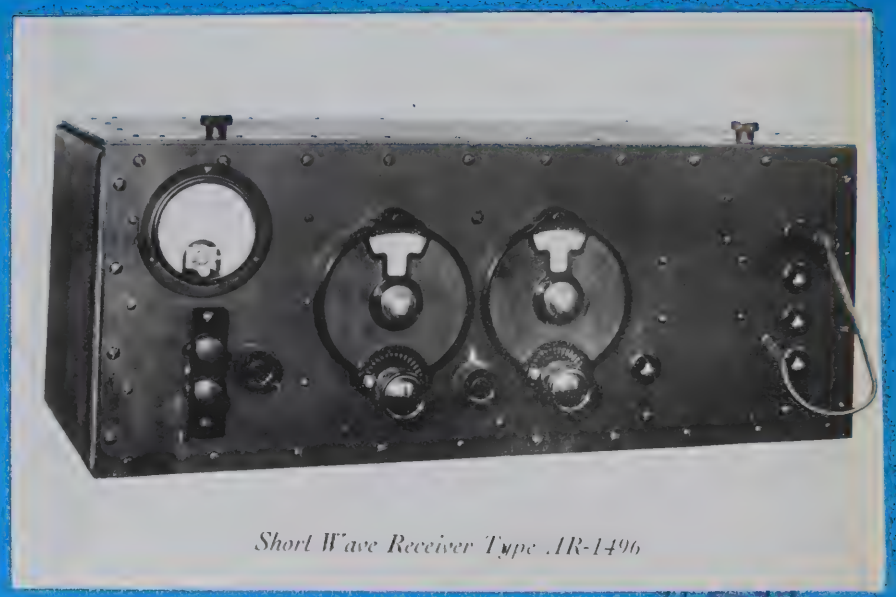
MARLO G. ABERNATHY



Short Wave Receiver Type AR-1496

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37 SHORT WAVE RECEIVER; type AR-1496.

This is a completely shielded short wave set having a wavelength range of 12 to 70 meters by means of plug-in coils.

This set has one stage of radio frequency amplification using the new four-element tube, followed by a regenerative and two audio frequency stages.

It is compactly designed and may be used for Portable and Marine service.

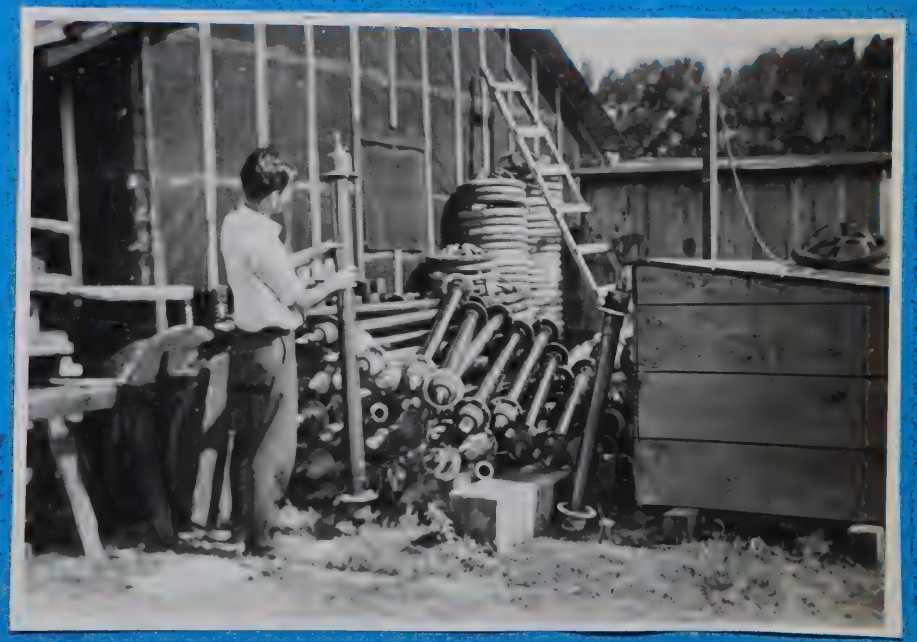
ALTERNATOR TUNING COIL HOUSE—
DOWNLEAD FRAME (NO ANTENNA) KAHUKU.
COOLING TOWER IN BACKGROUND

POWER HOUSE — KAHUKU, OAHU - 1931
NOT YET FIRED UP

CAPACITORS - 300 KW SPARK KAHUKU 1931

7644 44

KIK KAHUKU 1931
ANTENNA INSULATORS, CORONA SHIELDS



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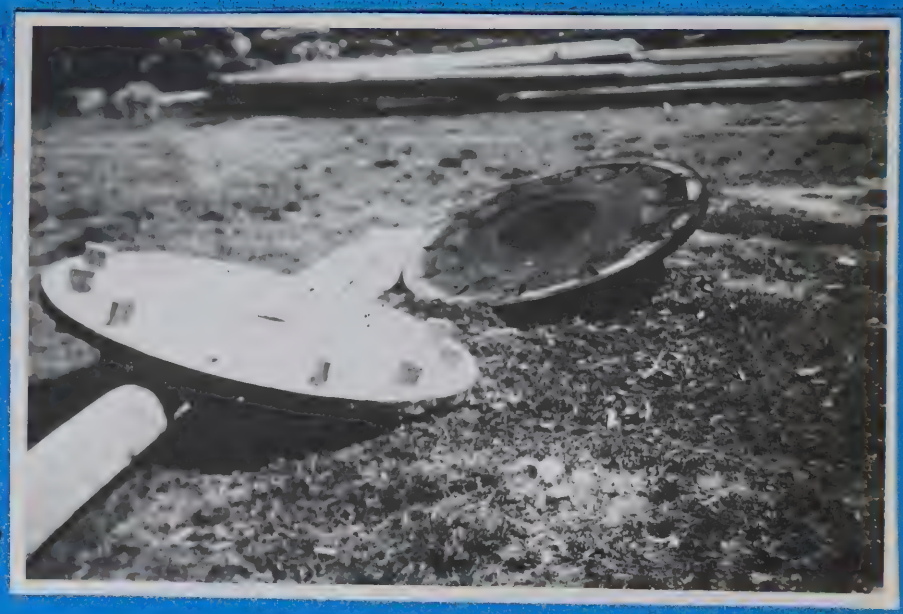
MARLO G. ABERNATHY

CAPACITORS
EX-300KW
SPARK SET
KAHUKU
1931



ROTARY GAP
PARTS —
EX 300KW
SPARK —
KAHUKU 1931

KAHUKU POWER
HOUSE — NOT YET
FIRED UP — 1931

OPPOSITION
KPH
MARSHALL
CALIF 1979

RCA ALTERNATOR TUNING COIL HOUSE
KAHUKU 1931

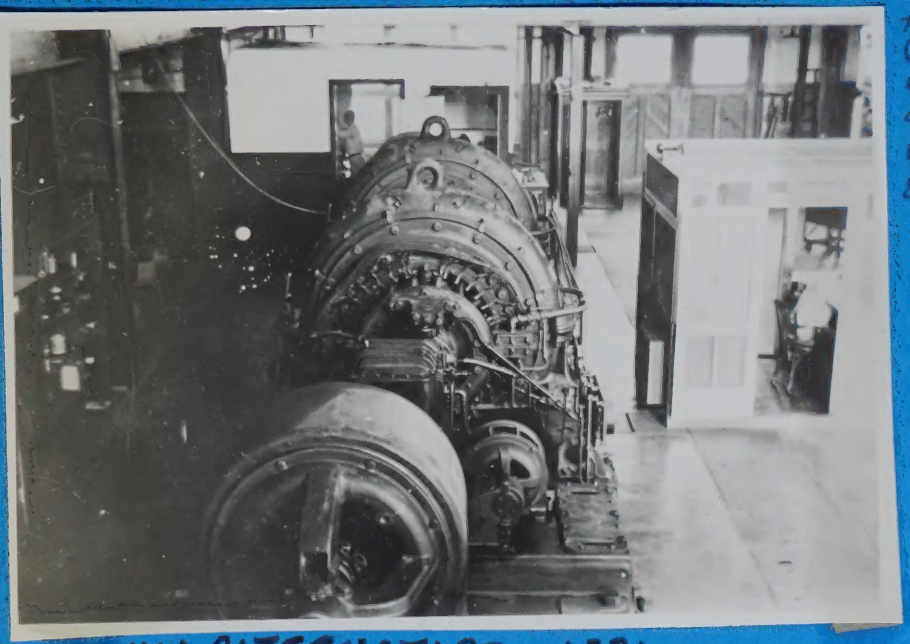
RCA 300 KW STEAM TURBINE & 500 CPS
ALTERNATOR FOR 300 KW SPARK SET—
(IN STORAGE 1931)

KAHUKU POWERHOUSE— 1931

ALTERNATOR ANTENNA TUNING COIL
FOUNDATION, DOWNLEAD & ANCHORS 1931

MARLO G. ABERNATHY

33



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KAHUKU ALTERNATORS — 1931

33 LARGE PHOTO RECEIVER MAKING PICTURES 56 INCHES WIDE.

This receiver is designed on the same principle as the small machine which makes pictures 5 inches in width. The actual recording is by means of a hot air jet on heat sensitive paper. The hot air gun travels the 30 inch width of the receiver in the same length of time as one stroke of the transmitter. The gun consequently travels six times as far as does the light beam in the transmitter.

The large photo radio receiver is designed for demonstration and exhibition purposes. A great number of people may watch the operation of picture recording from a distance by means of this device.

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